

WHAT IS CLAIMED IS:

1 1. A differential interferometric confocal microscope for measuring an object,
2 said microscope comprising:
3 a source-side pinhole array;
4 a detector-side pinhole array; and
5 an interferometer that images the array of pinholes of the source-side pinhole
6 array onto a first array of spots located in front of an object plane located near where the
7 object is positioned and onto a second array of spots behind the object plane, wherein the
8 first and second arrays of spots are displaced relative to each other in a direction that is
9 normal to the object plane, said interferometer also (1) imaging the first arrays of spots
10 onto a first image plane that is behind the detector-side pinhole array, (2) imaging the
11 first array of spots onto a second image plane, (3) imaging the second array of spots onto
12 the second image plane, and (4) imaging the second array of spots onto a third image
13 plane that is in front of the plane defined by the detector-side pinhole array,
14 wherein each spot of the imaged first array of spots in the first image plane is
15 aligned with a corresponding different spot of the imaged second array of spots in the
16 second image plane and a corresponding different pinhole of the detector-side pinhole
17 array, and
18 wherein each spot of the imaged first array of spots in the second image plane
19 coincides with a corresponding different spot of the imaged second array of spots in the
20 second image plane and is aligned with a corresponding different pinhole of the detector-
21 side pinhole array.

1 2. A differential interferometric confocal microscope for measuring an object,
2 said microscope comprising:
3 a source-side pinhole array for producing an array of input beams; and
4 a detector-side pinhole array; and
5 an interferometer including:
6 a first optical element providing a first reflecting surface;
7 a second optical element providing a second reflecting surface; and

8 a beam splitter positioned between the first and second optical elements,
9 wherein the beam splitter produces from the array of input beams a first array of
10 measurement beams and a second array of measurement beams,
11 wherein the first reflecting surface participates in focusing the first array of
12 measurement beams onto a first array of locations on a first object plane in object space
13 and the second reflecting surface participates in focusing the second array of
14 measurement beams onto a second array of locations on a second object plane in object
15 space, said first and second object planes being parallel to and displaced from each other,
16 wherein the first array of measurement beams generates a first array of return
17 beams from the object and the second array of measurement beams generates a second
18 array of return beams from the object,
19 wherein the first and second reflecting elements participate in producing from the
20 first array of return beams (1) a first array of converging beams that converge to a first
21 array of spots on a first image plane and (2) a second array of converging beams that
22 converge onto a second array of spots on a second image plane,
23 wherein the first and second reflecting elements participate in producing from the
24 second array of return beams (1) a third array of converging beams that converge onto the
25 second array of spots on the second image plane and (2) a fourth array of converging
26 beams that converge onto a third array of spots on a third image plane,
27 wherein said first and third image planes are adjacent to and on opposite sides of
28 the detector-side pinhole array, and the second image plane lies between the first and
29 third image planes, and
30 wherein the detector-side pinhole array combines the first, second, third, and
31 fourth arrays of converging beams to form an array of output beams.

1 3. The differential interferometric confocal microscope of claim 2 wherein a
2 single pinhole array serves as both the source-side pinhole array and the detector-side
3 pinhole array.

1 4. The differential interferometric confocal microscope of claim 3, wherein the
2 first optical element is located between said single pinhole array and the beam splitter and

3 wherein the second optical element is located between a location at which the object is
4 positioned during use and the beam splitter, wherein the first reflecting surface has a
5 center of curvature for which there is a corresponding conjugate as viewed through the
6 beam splitter, and wherein the second reflecting surface has a center of curvature that is
7 displaced relative to the corresponding conjugate of the center of curvature of the first
8 reflecting surface.

1 5. The differential interferometric confocal microscope of claim 4, wherein the
2 conjugate of the center of curvature of the first reflecting surface and the center of
3 curvature of the second reflecting surface are displaced from each other in a direction that
4 is normal to a plane defined by the beam splitter.

1 6. The differential interferometric confocal microscope of claim 5, wherein the
2 first reflecting surface participates in focusing the first array of measurement beams via
3 the beam splitter onto the first array of locations and the second reflecting surface
4 participates in focusing the second array of measurement beams via the beam splitter
5 onto the second array of locations.

1 7. The differential interferometric confocal microscope of claim 6 wherein the
2 first reflecting surface is substantially concentric with a point on the object.

1 8. The differential interferometric confocal microscope of claim 8, wherein the
2 second optical element provides a refracting surface positioned between the object and
3 the beam splitter to receive light rays from the object.

1 9. The differential interferometric confocal microscope of claim 9, wherein the
2 first reflecting surface substantially conforms to a sphere having a first radius and the
3 refracting surface conforms to a sphere having a second radius, wherein the first radius is
4 greater than the second radius.

1 10. The differential interferometric confocal microscope of claim 9, wherein the
2 first optical element provides a refracting surface positioned between the beam splitter
3 and said single pinhole array.

1 11. The differential interferometric confocal microscope of claim 10 wherein the
2 second reflecting surface is substantially concentric with an image point on said single
3 pinhole array.

1 12. The differential interferometric confocal microscope of claim 11, wherein the
2 second reflecting surface substantially conforms to a sphere having a first radius and the
3 refracting surface conforms to a sphere having a second radius, wherein the first radius is
4 greater than the second radius.

1 13. The differential interferometric confocal microscope of claim 6, wherein said
2 single pinhole array is a two-dimensional array.

1 14. The differential interferometric confocal microscope of claim 13, wherein the
2 two-dimensional array is of equally-spaced holes.

1 15. The differential interferometric confocal microscope of claim 14, wherein the
2 equally-spaced holes are circular apertures.
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